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Original Article

Sleep quality and duration – Potentially modifiable risk factors for Coronary Artery Disease?

Monika Sharma [a,*], *J.P.S. Sawhney* [b], *Samhita Panda* [c]

[a] *Consultant Clinical Psychologist, Dharam Vira Heart Institute, Department of Sleep Medicine, Sir Ganga Ram Hospital, New Delhi, India*

[b] *Consultant Cardiologist, Dharam Vira Heart Institute, Sir Ganga Ram Hospital, New Delhi, India*

[c] *Consultant Neurophysiologist, Department of Sleep Medicine, Sir Ganga Ram Hospital, New Delhi, India*

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ABSTRACT

Purpose: Previous studies have shown that lack of sleep exerts deleterious effects on a variety of systems with detectable changes in metabolic, endocrine and immune pathways. Both short and long sleep durations are related to increased likelihood of diabetes and hypertension. However, the relation between sleep duration, sleep quality and Coronary Artery Disease (CAD) is not clear in the Indian population. We examined the hypothesis that sleep duration (compared with <6 h) and quality of sleep (PSQI > 5) are risk factors for CAD.

Methods: A retrospective & controlled study was conducted on 352 adult (>18 yrs) subjects (176 controls and 176 cases, 60% men, age M = 51 ± 9.38). Sleep quality and duration was measured with Pittsburg Sleep Quality Index (PSQI). Poor sleep quality and short sleep duration was defined as PSQI >5 and total sleep time <6.0 h, respectively. OSA patients were excluded from the study. The main outcome of interest was the presence of any CAD ($n = 176$), including MI, angina, and stroke. Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated using Multivariate Logistic Regression analysis.

Results: We found both poor quality of sleep and short sleep duration to be independently associated with CAD. Compared with a total sleep time of 6.0 h, the multivariate odds ratio (95% confidence interval) of CAD was 3.81 (1.69–8.58) whereas for poor sleep quality (PSQI > 5) it came out to be 16.62 (9.13–30.28).

Conclusion: There was a positive association between both short sleep duration and poor sleep quality with CAD in a selected sample of Indian adults. These results suggest that poor sleep quality and short sleep duration may be important modifiable CAD risk factors in the Indian population.

1. Introduction

Sleep is a natural activity in living beings which follows the diurnal rhythm and takes place automatically. But it has become a problem to the human beings. Previous studies have shown that lack of sleep exerts deleterious effects on a variety of systems with detectable changes in metabolic, endocrine and immune pathways. Both short and long sleep durations

* *Corresponding author*. Tel.: +91 9871933475; fax: +11 25861002.
E-mail address: Monika21in@gmail.com (M. Sharma).

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are related to increased likelihood of diabetes and hypertension.[1] Past few decades of epidemiological evidence has established that sleep disturbances are linked with mortality from cardiac and other causes.[2] Several epidemiologic surveys show a strong association between sleep complaints or shortened sleep durations and cardiovascular disorders.[3] A recent review provides strong evidence that short sleepers (>5 h of sleep/night) have a higher risk of coronary events.[2] However, insomnia, the most common sleep disorder in cardiac patients, has continued to be ignored. There is a huge lack of published literature on the relation between sleep duration, sleep quality and Coronary Artery Disease (CAD) in developing countries.

It was hypothesized that short sleep duration and poor sleep quality may play a role in CAD. The aim of the study was to analyze sleep duration and sleep quality in patients with CAD.

2. Method

2.1. Study population

We conducted a retrospective and controlled study. For this purpose, total of 352 subjects were recruited between July and November, 2012. Participants or their family members gave either written or oral informed consent at the time of enrollment. 176 consecutive cases from CCU of a tertiary care hospital with a recent diagnosis of CAD including myocardial infarction, angina, and stroke were enrolled. 176 controls were recruited from general community. Patients were excluded if they were suffering from sleep disorders including OSA and/or any other significant medical disorder contributing to poor sleep. In order to rule out any underlying sleep disorder including OSA, a detailed sleep history was taken in the presence of bed partner. Those reporting, loud and chronic (ongoing) snoring, gasping, complaint of dry mouth or sore throat on waking up, daytime headache, daytime hyper somnolence including fighting sleepiness during the day, at work, or while driving were excluded. Also, those experiencing cognitive and social impairments like memory, learning difficulties, lack of concentration, attention deficit, feeling irritable, depressed, or having mood swings or personality changes were excluded.

Poor Sleep quality was defined by "tiredness on waking" and/on reporting "un-refreshing mornings" whereas short sleep duration as total sleep time <6.0 h. Sleep quality and Sleep duration i.e., total sleep time (TST) was measured with Pittsburgh Sleep Quality Index [PSQI] by Buysse, 1989. The PSQI is a 19 item questionnaire that asks participants to report their typical sleep habits within the past month. In the present study, the period of one month was changed to one year, in order to have information about pre-morbid state. Each question of the PSQI is assigned a value between 0 and 3, some in conjunction with other questions in the questionnaire, and some questions assigned their own value. The PSQI measures sleep duration, sleep latency, day time dysfunction due to sleepiness, the efficiency of sleep, overall sleep quality, and the need for medication to aid sleep. The overall score of the PSQI is the combined scores of each of the individual measures [ranging from 0 to 21], with scores less than 5 representing better sleep quality and greater than 5 representing poor sleep quality (Buysse DJ, 1989). Short sleep duration was defined as sleeping <6.0 h, (reference group).[4]

Information on demographic profile and medical history was solicited through direct interview. These variables included age, sex, marital status, hypertension, diabetes. Statistical analyses were carried out using SAS statistical software version 9.2 (SAS Institute, INC., Cary, NC). Participants' characteristics are presented as mean ± SD/Median for continuous variables, or percentages for categorical variables. Multivariate Logistic regression analysis was used to estimate Odds ratios (ORs) and 95% confidence intervals (95% CIs) of CAD in sleep categories. Participants with a normal sleep duration of ≥6 h were considered as the reference group for short sleep duration.

3. Results

The study enrolled 352 patients, out of which 176 were recently diagnosed with CAD and remaining were healthy controls from general community. All participants were administered questionnaire to solicit demographic, medical and information on sleep quality and duration. Majority of total subjects were male (60.5%) with average age of 49.9 years. Table 1 shows the demographic and medical profile of the participants. Of them, majority were male (60.5%), 29.8% had HT, 23% had DM. Table 2 shows the comparison among demographic variables, and quality of sleep (poor), sleep duration (short), stratified by subjects with and without CAD. 68.8% patients with CAD suffered from poor sleep quality compared to 10.2% without CAD ($p = 0.001$). 17% CAD patients slept for less than 6 h/day whereas only 6.3% participants without CAD reported of sleeping less than 6 h ($p = 0.001$). Median Score on PSQI for control group was 2 and for cases it was 7 ($p = 0.001$). Median total sleep time (TST) for participants without CAD was 7.16 whereas for those with diagnosis of CAD was 7 ($p = 0.001$). Seventy nine CAD subjects said yes to snoring (44.9%) whereas 29.5% from controls group reported the same ($p = 0.003$). Median score on PSQI for control group was 2 and for cases was 7 ($p = 0.001$). Median Total sleep time (TST) for participants without CAD was 7.16 whereas for those with diagnosis of CAD was 7 ($p = 0.001$). Compared with subjects without CAD, among subjects with CAD, sleeping less than 6 h, was associated with an increased OR (3.81) of CAD events. Poor Sleep quality in terms of having restless or disturbed nights with un refreshing mornings was also associated with increased OR (16.62) of CAD (Table 3).

Table 1 – Demographic and medical profile of the participants.

	$n = 356$
Age (years)	49.9
Female	39.50%
Male	60.50%
HTN	29.80%
DM	23%

Table 2 – Comparison among study variables, stratified by subjects with and without CAD.

	Controls ($n = 176$)		Cases ($n = 176$)		p Value
Age	50.19 ± 6.42	42–77	51.51 ± 11.58	20–85	0.190
Female	61	34.7%	78	44.3%	0.064
Married	167	94.9%	142	80.7%	<0.001
PSQI > 5	18	10.2%	121	68.8%	<0.001
TST < 6.0	11	6.3%	30	17.0%	0.002

4. Discussion

To our knowledge, this is the first study which examined the association between sleep duration and sleep quality in Indian patients with CAD. Previous studies found significant association between short (less than 6 h) and long sleep duration (more than 8 h) and CHD, DM, and HT in general population.[1] Previous studies of Americans or Europeans support our findings. The Nurses' Health Study of 71,617 women aged 40–65 years reported that, compared with 8 h of sleep, short sleep duration of 5 h or less was associated with a 1.4-fold increase in risk of coronary heart disease.[5]

This study shows a positive association between the manifestation of CAD with poor quality of sleep and short sleep duration. Multivariate logistic analysis indicate that short sleepers (<6 h/day) have a greater risk of developing CAD than those sleeping more than 6 h/day. Furthermore, poor quality of sleep also shows an increased risk for these events, confirming the presence of a U-shape association.

The literature supports the view that short or long sleep duration is independently associated with an increased likelihood of coronary events.[5–7] Increased unadjusted CHD risk was found in both short sleeper groups (extremely short ≤5 h, and 6 h sleepers) and extremely long sleepers (≥10 h) in both genders when compared with midrange (7–8 h) sleepers. Another study by Amagai, Y. et al, has shown Short sleep duration (<6 h) as a significant risk factor for coronary events in a Japanese male working population.[8] The risk of CHD events was independent of prominent cardiovascular risk factors and occupational factors.[9] Short sleep duration imposed on a group of healthy subjects increased sympathetic nervous system activity and blood pressure elevation. Therefore, sustained short sleep duration could lead to adverse cardiovascular consequence.

The relation between short sleep duration and CVD incidence could be due to an effect of short sleep on intermediate biological CVD risk factors. Epidemiological studies showed that short sleep duration was associated with higher incidence of overweight, obesity, and hypertension, with higher levels of blood pressure, total cholesterol, hemoglobin A (1c), and triglycerides.[10–12] Also, blood pressure declines to its lowest levels during nighttime sleep when the parasympathetic activity is highest.[13] Consequently, the arteries of people with short sleep duration benefit the least from this positive effect.

Also, sleep quality may modify the association between sleep duration and CVD. Sleep quality is an important factor in the physiologic recovery of the body during sleep, and good sleep quality may prevent CVD.[12] Chandola et al found in the Whitehall II cohort that the association of short sleep (≤6 h) with CHD risk was greatest among those who reported some sleep disturbance. These findings support the hypothesis that for some people, sleep duration of 6 h or less may be adequate for the restorative physiologic processes accompanied by sleep, but not for others.[14]

Table 3 – Multivariate logistic regression analysis.

Variables	p Value	Odds ratio	95% CI
Unmarried	0.004	3.00	1.00–9.00
PSQI > 5	<0.001	16.62	9.13–30.28
TST < 6	0.001	3.81	1.69–8.58

5. Limitations

The present study had some limitations. The major limitations of the study were small sample size, which was a constraint for the adjustment of the potential confounders in the analysis. Therefore, it is difficult to interpret the causality of our findings. We did not have data about the other confounders like hyperlipidemia, alcohol intake, and exercise frequency and therefore could not control these factors in the analysis confounders. Unfortunately, we were unable to assess the effects of overweight, obesity, and hypertension, with higher levels of blood pressure, total cholesterol, homeglobin A (1c), and triglycerides on our results.

Objective measurements of sleep duration, blood pressure, and glucose were lacking, which is another limitation of our study.

6. Conclusion

Recognition of short sleep duration and poor sleep quality is a new area of research that may impact the management of patients with CVD.

Whether improving sleep quality and duration enables the reversal of chronic cardiovascular and metabolic consequences of sleep disorders, remains to be studied in adequately designed studies, particularly in comparison with usual strategies.

Conflicts of interest

All authors have none to declare.

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